

WHAT IS CLAIMED IS:

1. A multi-beam optical scanning apparatus comprising:
  - light source means including a plurality of radiation points disposed with being spaced from each other in a main scanning direction; and
  - deflecting means for deflecting a plurality of light beams radiated from said plurality of radiation points toward a surface to be scanned;
- 10       wherein wherein where a first radiation point is a radiation point for radiating the light beam, out of the plurality of light beams emitted from said plurality of radiation points, which reaches the farthest location from a center of a deflecting facet of said deflecting means in the main scanning direction, a second radiation point is a radiation point for radiating another light beam, and an upstream-side external angular range is a range which lies in an angular range over which the light beam
- 15       can be deflected by said deflecting means, and which exists on an upstream side in a rotational direction of said deflecting means relative to an effective scanning angular range at the time when the light beam is deflected toward an effective scanning range
- 20       on the surface to be scanned, control is performed such that the light beam from said second radiation point can be radiated prior to the light beam from
- 25

said first radiation point in the upstream-side external angular range.

2. A multi-beam optical scanning apparatus  
5 according to claim 1, wherein the light beam of said radiation point for radiating the light beam reaching a location nearest a center of the deflecting facet of said deflecting means is radiated in the first place, out of the plurality of light beams radiated  
10 by said light source means.

3. A multi-beam optical scanning apparatus according to claim 2, wherein the light beam of said radiation point for radiating the light beam reaching 15 a location nearer the center of the deflecting facet of said deflecting means is radiated in the order from the nearest location, out of the plurality of light beams radiated by said light source means.

20 4. A multi-beam optical scanning apparatus comprising:

light source means including a plurality of radiation points disposed with being spaced from each other in a main scanning direction; and

25 deflecting means for deflecting a plurality of light beams radiated from said plurality of radiation points toward a surface to be scanned, the plurality

of light beams radiated from said plurality of radiation points intersecting each other M times ( $M=2n+1$ ; n is an integer) between said light source means and said deflecting means;

5       wherein where a first radiation point is a radiation point disposed on a most upstream side in a rotational direction of said deflecting means, out of said plurality of radiation points, a second radiation point is a radiation point for radiating another light beam, and an upstream-side external angular range is a range which lies in an angular range over which the light beam can be deflected by said deflecting means, and which exists on the upstream side in the rotational direction of said 10 deflecting means relative to an effective scanning angular range at the time when the light beam is deflected toward an effective scanning range on the surface to be scanned, control is performed such that the light beam from said second radiation point can 15 be radiated prior to the light beam from said first radiation point in the upstream-side external angular range.

5. A multi-beam optical scanning apparatus  
25 according to claim 4, wherein the light beam of said radiation point disposed on a most downstream side in the rotational direction of said deflecting means is

radiated in the first place.

6. A multi-beam optical scanning apparatus according to claim 5, wherein the light beam of said  
5 radiation point disposed on the more downstream side in the rotational direction of said deflecting means is radiated in the order from the most downstream side.

10 7. A multi-beam optical scanning apparatus according to claim 4, wherein the radiation amount of the light beam is adjusted by radiating the light beam from said radiation point of said light source means in the upstream-side external angular range  
15 prior to the effective scanning range on the surface to be scanned.

8. A multi-beam optical scanning apparatus according to claim 4, further comprising a scanning  
20 optical system for forming images of the plurality of light beams deflected by said deflecting means on the surface to be scanned; and synchronous detecting means for detecting writing start timings on the surface to be scanned by receiving the plurality of  
25 light beams deflected by said deflecting means; and wherein synchronous detection is performed by radiating the light beam directed to said synchronous

detecting means from said radiation point of said light source means in the upstream-side external angular range prior to the effective scanning range on the surface to be scanned.

5

9. A multi-beam optical scanning apparatus according to claim 4, wherein a chamfered portion is formed at an edge of a deflecting facet of said deflecting means.

10

10. A multi-beam optical scanning apparatus according to claim 4, wherein where a third radiation point is another radiation point other than said first radiation point disposed on the most upstream side in the rotational direction of said deflecting means, the light beam of said third radiation point is radiated in the first place in a downstream-side external angular range subsequent to the effective scanning range on the surface to be scanned.

15

20  
11. A multi-beam optical scanning apparatus comprising:

light source means including a plurality of radiation points disposed with being spaced from each other in a main scanning direction; and  
25  
deflecting means for deflecting a plurality of light beams radiated from said plurality of radiation

points toward a surface to be scanned, the plurality  
of light beams radiated from said plurality of  
radiation points intersecting each other N times  
(N=2n; n is an integer) between said light source  
5 means and said deflecting means;

wherein where a first radiation point is a  
radiation point disposed on a most downstream side in  
a rotational direction of said deflecting means, out  
of said plurality of radiation points, a second  
10 radiation point is a radiation point for radiating  
another light beam, and an upstream-side external  
angular range is a range which lies in an angular  
range over which the light beam can be deflected by  
said deflecting means, and which exists on the  
15 upstream side in the rotational direction of said  
deflecting means relative to an effective scanning  
angular range at the time when the light beam is  
deflected toward an effective scanning range on the  
surface to be scanned, control is performed such that  
20 the light beam from said second radiation point can  
be radiated prior to the light beam from said first  
radiation point in the upstream-side external angular  
range.

25           12. A multi-beam optical scanning apparatus  
according to claim 11, wherein the light beam of said  
radiation point disposed on the most upstream side in

the rotational direction of said deflecting means is radiated in the first place.

13. A multi-beam optical scanning apparatus  
5 according to claim 12, wherein the light beam of said radiation point disposed on the more upstream side in the rotational direction of said deflecting means is radiated in the order from the most upstream side.

10 14. A multi-beam optical scanning apparatus according to claim 11, wherein the radiation amount of the light beam is adjusted by radiating the light beam from said radiation point of said light source means in the upstream-side external angular range  
15 prior to the effective scanning range on the surface to be scanned.

15. A multi-beam optical scanning apparatus according to claim 11, further comprising a scanning optical system for forming images of the plurality of light beams deflected by said deflecting means on the surface to be scanned; and synchronous detecting means for detecting writing start timings on the surface to be scanned by receiving the plurality of  
20 light beams deflected by said deflecting means; and wherein synchronous detection is performed by  
25 radiating the light beam directed to said synchronous

detecting means from said radiation point of said light source means in the upstream-side external angular range prior to the effective scanning range on the surface to be scanned.

5

16. A multi-beam optical scanning apparatus according to claim 11, wherein a chamfered portion is formed at an edge of a deflecting facet of said deflecting means.

10

17. A multi-beam optical scanning apparatus according to claim 11, wherein where a third radiation point is another radiation point other than said first radiation point disposed on the most downstream side in the rotational direction of said deflecting means, the light beam of said third radiation point is radiated in the first place in a downstream-side external angular range subsequent to the effective scanning range on the surface to be scanned.

20

18. A multi-beam optical scanning apparatus comprising:

light source means including a plurality of radiation points disposed with being spaced from each other in a main scanning direction; and deflecting means for deflecting a plurality of

light beams radiated from said plurality of radiation points toward a surface to be scanned;

wherein the light beam of said radiation point for radiating the light beam firstly incident on a 5 deflecting facet of said deflecting means in the main scanning direction is radiated prior to the light beam from the other radiation point.

19. A multi-beam optical scanning apparatus 10 according to claim 18, further comprising a scanning optical system for forming images of the plurality of light beams deflected by said deflecting means on the surface to be scanned; and synchronous detecting means for detecting writing start timings on the 15 surface to be scanned by receiving the plurality of light beams deflected by said deflecting means; and wherein synchronous detection is performed by radiating the light beam directed to said synchronous detecting means from said radiation point of said 20 light source means in the upstream-side external angular range prior to the effective scanning range on the surface to be scanned.

20. A multi-beam optical scanning apparatus 25 according to any one of claims 1, 4, 11 and 18, wherein said light source means is comprised of a monolithic semiconductor laser.

21. An image forming apparatus comprising:  
a multi-beam optical scanning apparatus recited  
in any one of claims 1, 4, 11 and 18;  
an image bearing member placed at the surface  
5 to be scanned;  
developing means for developing an  
electrostatic latent image, which is formed on said  
image bearing member by the light beam scanned by  
said multi-beam optical scanning apparatus, as a  
10 toner image;  
transferring means for transferring the  
developed toner image onto a transferring material;  
and  
fixing means for fixing the transferred toner  
15 image on the transferring material.

22. An image forming apparatus comprising:  
a multi-beam optical scanning apparatus recited  
in claim 21; and  
20 a printer controller for converting code data  
input from an external apparatus into an image signal  
to supply the image signal to said multi-beam optical  
scanning apparatus.

25 23. A color image forming apparatus comprising:  
a plurality of multi-beam optical scanning  
apparatuses each of which includes a multi-beam

optical scanning apparatus recited in any one of claims 1, 4, 11 and 18; and

a plurality of image bearing members each of which is placed at the surface to be scanned of said 5 each multi-beam optical scanning apparatus, and which form images of different colors, respectively.

24. A color image forming apparatus comprising:

a multi-beam optical scanning apparatus recited 10 in claim 23; and

a printer controller for converting code data input from an external apparatus into an image signal to supply the image signal to said multi-beam optical scanning apparatus.

15

25. A multi-beam optical scanning apparatus comprising:

light source means including at least three radiation points disposed with being spaced from each 20 other in a main scanning direction; and

deflecting means for deflecting at least three light beams radiated from said at least three radiation points toward a surface to be scanned;

wherein where a first radiation point is a 25 radiation point for radiating the light beam, out of the at least three light beams emitted from said at least three radiation points, which reaches the

farthest location from a center of a deflecting facet of said deflecting means in the main scanning direction, a second radiation point is a radiation point for radiating another light beam, and an

5 upstream-side external angular range is a range which lies in an angular range over which the light beam can be deflected by said deflecting means, and which exists on an upstream side in a rotational direction of said deflecting means relative to an effective

10 scanning angular range at the time when the light beam is deflected toward an effective scanning range on the surface to be scanned, control is performed such that the light beam from said second radiation point can be radiated prior to the light beam from

15 said first radiation point in the upstream-side external angular range.

26. A multi-beam optical scanning apparatus according to claim 25, wherein the light beam of said 20 radiation point for radiating the light beam reaching a location nearest a center of the deflecting facet of said deflecting means is radiated in the first place, out of the at least three light beams radiated by said light source means.

25

27. A multi-beam optical scanning apparatus according to claim 26, wherein the light beam of said

radiation point for radiating the light beam reaching  
a location nearer the center of the deflecting facet  
of said deflecting means is radiated in the order  
from the nearest location, out of the at least three  
5 light beams radiated by said light source means.

28. A multi-beam optical scanning apparatus  
comprising:

light source means including at least three  
10 radiation points disposed with being spaced from each  
other in a main scanning direction; and

deflecting means for deflecting at least three  
light beams radiated from said at least three  
radiation points toward a surface to be scanned, the  
15 at least three light beams radiated from said at  
least three radiation points intersecting each other  
M times ( $M=2n+1$ ; n is an integer) between said light  
source means and said deflecting means;

wherein where a first radiation point is a  
20 radiation point disposed on a most upstream side in a  
rotational direction of said deflecting means, out of  
said at least three radiation points, a second  
radiation point is a radiation point for radiating  
another light beam, and an upstream-side external  
25 angular range is a range which lies in an angular  
range over which the light beam can be deflected by  
said deflecting means, and which exists on the

upstream side in the rotational direction of said deflecting means relative to an effective scanning angular range at the time when the light beam is deflected toward an effective scanning range on the 5 surface to be scanned, control is performed such that the light beam from said second radiation point can be radiated prior to the light beam from said first radiation point in the upstream-side external angular range.

10

29. A multi-beam optical scanning apparatus according to claim 28, wherein the light beam of said radiation point disposed on a most downstream side in the rotational direction of said deflecting means is 15 radiated in the first place.

30. A multi-beam optical scanning apparatus according to claim 29, wherein the light beam of said radiation point disposed on the more downstream side 20 in the rotational direction of said deflecting means is radiated in the order from the most downstream side.

31. A multi-beam optical scanning apparatus 25 according to claim 28, wherein the radiation amount of the light beam is adjusted by radiating the light beam from said radiation point of said light source

means in the upstream-side external angular range prior to the effective scanning range on the surface to be scanned.

5           32. A multi-beam optical scanning apparatus according to claim 28, further comprising a scanning optical system for forming images of the at least light beams deflected by said deflecting means on the surface to be scanned; and synchronous detecting  
10          means for detecting writing start timings on the surface to be scanned by receiving the at least three light beams deflected by said deflecting means; and wherein synchronous detection is performed by radiating the light beam directed to said synchronous  
15          detecting means from said radiation point of said light source means in the upstream-side external angular range prior to the effective scanning range on the surface to be scanned.

20           33. A multi-beam optical scanning apparatus according to claim 28, wherein a chamfered portion is formed at an edge of a deflecting facet of said deflecting means.

25           34. A multi-beam optical scanning apparatus according to claim 28, wherein where a third radiation point is another radiation point other than

said first radiation point disposed on the most upstream side in the rotational direction of said deflecting means, the light beam of said third radiation point is radiated in the first place in a downstream-side external angular range subsequent to the effective scanning range on the surface to be scanned.

35. A multi-beam optical scanning apparatus  
10 comprising:

light source means including at least three radiation points disposed with being spaced from each other in a main scanning direction; and  
deflecting means for deflecting at least three  
15 light beams radiated from said at least three radiation points toward a surface to be scanned, the at least three light beams radiated from said at least three radiation points intersecting each other N times ( $N=2n$ ; n is an integer) between said light  
20 source means and said deflecting means;

wherein where a first radiation point is a radiation point disposed on a most downstream side in a rotational direction of said deflecting means, out of said at least three radiation points, a second  
25 radiation point is a radiation point for radiating another light beam, and an upstream-side external angular range is a range which lies in an angular

range over which the light beam can be deflected by said deflecting means, and which exists on the upstream side in the rotational direction of said deflecting means relative to an effective scanning  
5 angular range at the time when the light beam is deflected toward an effective scanning range on the surface to be scanned, control is performed such that the light beam from said second radiation point can be radiated prior to the light beam from said first  
10 radiation point in the upstream-side external angular range.

36. A multi-beam optical scanning apparatus according to claim 35, wherein the light beam of said  
15 radiation point disposed on the most upstream side in the rotational direction of said deflecting means is radiated in the first place.

37. A multi-beam optical scanning apparatus according to claim 36, wherein the light beam of said  
20 radiation point disposed on the more upstream side in the rotational direction of said deflecting means is radiated in the order from the most upstream side.

25 38. A multi-beam optical scanning apparatus according to claim 35, wherein the radiation amount of the light beam is adjusted by radiating the light

beam from said radiation point of said light source means in the upstream-side external angular range prior to the effective scanning range on the surface to be scanned.

5

39. A multi-beam optical scanning apparatus according to claim 35, further comprising a scanning optical system for forming images of the at least three light beams deflected by said deflecting means 10 on the surface to be scanned; and synchronous detecting means for detecting writing start timings on the surface to be scanned by receiving the at least three light beams deflected by said deflecting means; and wherein synchronous detection is performed 15 by radiating the light beam directed to said synchronous detecting means from said radiation point of said light source means in the upstream-side external angular range prior to the effective scanning range on the surface to be scanned.

20

40. A multi-beam optical scanning apparatus according to claim 35, wherein a chamfered portion is formed at an edge of a deflecting facet of said deflecting means.

25

41. A multi-beam optical scanning apparatus according to claim 35, wherein where a third

radiation point is another radiation point other than said first radiation point disposed on the most downstream side in the rotational direction of said deflecting means, the light beam of said third

5 radiation point is radiated in the first place in a downstream-side external angular range subsequent to the effective scanning range on the surface to be scanned.

10 42. A multi-beam optical scanning apparatus comprising:

light source means including at least three radiation points disposed with being spaced from each other in a main scanning direction; and

15 deflecting means for deflecting at least three light beams radiated from said at least three radiation points toward a surface to be scanned;

wherein the light beam of said radiation point for radiating the light beam firstly incident on a 20 deflecting facet of said deflecting means in the main scanning direction is radiated prior to the light beam from the other radiation point.

43. A multi-beam optical scanning apparatus according to claim 42, further comprising a scanning optical system for forming images of the at least 25 three light beams deflected by said deflecting means

on the surface to be scanned; and synchronous  
detecting means for detecting writing start timings  
on the surface to be scanned by receiving the at  
least three light beams deflected by said deflecting  
5 means; and wherein synchronous detection is performed  
by radiating the light beam directed to said  
synchronous detecting means from said radiation point  
of said light source means in the upstream-side  
external angular range prior to the effective  
10 scanning range on the surface to be scanned.

44. A multi-beam optical scanning apparatus  
according to any one of claims 25, 28, 35 and 42,  
wherein said light source means is comprised of a  
15 monolithic semiconductor laser.

45. An image forming apparatus comprising:  
a multi-beam optical scanning apparatus recited  
in any one of claims 25, 28, 35 and 42;  
20 an image bearing member placed at the surface  
to be scanned;  
developing means for developing an  
electrostatic latent image, which is formed on said  
image bearing member by the light beam scanned by  
25 said multi-beam optical scanning apparatus, as a  
toner image;  
transferring means for transferring the

developed toner image onto a transferring material;  
and

fixing means for fixing the transferred toner  
image on the transferring material.

5

46. An image forming apparatus comprising:

a multi-beam optical scanning apparatus recited  
in claim 45; and

a printer controller for converting code data

10 input from an external apparatus into an image signal  
to supply the image signal to said multi-beam optical  
scanning apparatus.

47. A color image forming apparatus comprising:

15 a plurality of multi-beam optical scanning  
apparatuses each of which includes a multi-beam  
optical scanning apparatus recited in any one of  
claims 25, 28, 35 and 42; and

20 a plurality of image bearing members each of  
which is placed at the surface to be scanned of said  
each multi-beam optical scanning apparatus, and which  
form images of different colors, respectively.

48. A color image forming apparatus comprising:

25 a multi-beam optical scanning apparatus recited  
in claim 47; and

a printer controller for converting code data

input from an external apparatus into an image signal to supply the image signal to said multi-beam optical scanning apparatus.

5        49. A multi-beam optical scanning apparatus comprising:

            light source means including a plurality of radiation points disposed with being spaced from each other in a main scanning direction; and

10        deflecting means for deflecting a plurality of light beams radiated from said plurality of radiation points toward a surface to be scanned;

            wherein where a first radiation point is a radiation point for radiating the light beam, out of the plurality of light beams emitted from said plurality of radiation points, which reaches the farthest location from a center of a deflecting facet of said deflecting means in the main scanning direction, a second radiation point is a radiation point for radiating another light beam, and an upstream-side external angular range is a range which lies in an angular range over which the light beam can be deflected by said deflecting means, and which exists on an upstream side in a rotational direction of said deflecting means relative to an effective scanning angular range at the time when the light beam is deflected toward an effective scanning range

on the surface to be scanned, a width of the deflecting facet in a main scanning section is set to such a magnitude that the light beam reaching the location most spaced from the center of the

5 deflecting facet at an end portion of the deflecting facet is eclipsed in the event that the light beam from said first radiation point for radiating the light beam reaching the location most spaced from the center of the deflecting facet is radiated prior to

10 the light beam from said second radiation point in the upstream-side external angular range, and control is performed such that the light beam from said second radiation point can be radiated prior to the light beam from said first radiation point in the

15 upstream-side external angular range.

50. A multi-beam optical scanning apparatus comprising:

light source means including a plurality of  
20 radiation points disposed with being spaced from each other in a main scanning direction; and  
deflecting means for deflecting a plurality of light beams radiated from said plurality of radiation points toward a surface to be scanned;

25 wherein a width of the deflecting facet in a main scanning section is set to such a magnitude that the light beam last incident on an end portion of the

deflecting facet is eclipsed in the event that the light beam from said radiation point for radiating the light beam last incident on the deflecting facet of said deflecting means is radiated prior to the  
5 light beam from the other radiation point, and the light beam of said radiation point for radiating the light beam firstly incident on the deflecting facet of said deflecting means in the main scanning direction is radiated prior to the light beam from  
10 the other radiation point.

51. A multi-beam optical scanning apparatus comprising:

light source means including at least three  
15 radiation points disposed with being spaced from each other in a main scanning direction; and  
deflecting means for deflecting at least three light beams radiated from said at least three radiation points toward a surface to be scanned;  
20 wherein where a first radiation point is a radiation point for radiating the light beam, out of the at least three light beams emitted from said at least three radiation points, which reaches the farthest location from a center of a deflecting facet  
25 of said deflecting means in the main scanning direction, a second radiation point is a radiation point for radiating another light beam, and an

upstream-side external angular range is a range which lies in an angular range over which the light beam can be deflected by said deflecting means, and which exists on an upstream side in a rotational direction  
5 of said deflecting means relative to an effective scanning angular range at the time when the light beam is deflected toward an effective scanning range on the surface to be scanned, a width of the deflecting facet in a main scanning section is set to  
10 such a magnitude that the light beam reaching the farthest location from a center of the deflecting facet at an end portion of the deflecting facet is eclipsed in the event that the light beam from said first radiation point for radiating the light beam  
15 reaching the location most spaced from the center of the deflecting facet is radiated prior to the light beam from said second radiation point in the upstream-side external angular range, and control is performed such that the light beam from said second  
20 radiation point can be radiated prior to the light beam from said first radiation point in the upstream-side external angular range.

52. A multi-beam optical scanning apparatus  
25 comprising:  
light source means including at least three radiation points disposed with being spaced from each

other in a main scanning direction; and  
deflecting means for deflecting at least three  
light beams radiated from said at least three  
radiation points toward a surface to be scanned;

5       wherein a width of a deflecting facet of said  
deflecting means in a main scanning section is set to  
such a magnitude that the light beam last reaching an  
end portion of the deflecting facet is eclipsed in  
the event that the light beam from said radiation  
10      point for radiating the light beam last incident on  
the deflecting facet of said deflecting means is  
radiated prior to the light beam from the other  
radiation point, and the light beam from said  
radiation point for radiating the light beam firstly  
15      incident on the deflecting facet of said deflecting  
means in the main scanning direction is radiated  
prior to the light beam from the other radiation  
point.

20       53. An image forming apparatus comprising:  
          a multi-beam optical scanning apparatus recited  
          in any one of claims 49 to 52;  
          an image bearing member placed at the surface  
          to be scanned;

25       developing means for developing an  
          electrostatic latent image, which is formed on said  
          image bearing member by the light beam scanned by

said multi-beam optical scanning apparatus, as a toner image;

transferring means for transferring the developed toner image onto a transferring material;

5 and

fixing means for fixing the transferred toner image on the transferring material.

54. An image forming apparatus comprising:

10 a multi-beam optical scanning apparatus recited in claim 53; and

a printer controller for converting code data input from an external apparatus into an image signal to supply the image signal to said multi-beam optical 15 scanning apparatus.

55. A color image forming apparatus comprising:

a plurality of multi-beam optical scanning apparatuses each of which includes a multi-beam 20 optical scanning apparatus recited in any one of claims 49 to 52; and

a plurality of image bearing members each of which is placed at the surface to be scanned of said 25 each multi-beam optical scanning apparatus, and which form images of different colors, respectively.

56. A color image forming apparatus comprising:

a multi-beam optical scanning apparatus recited  
in claim 55; and

a printer controller for converting code data  
input from an external apparatus into an image signal  
5 to supply the image signal to said multi-beam optical  
scanning apparatus.